

MEMORANDUM

CH2MHILL

Comments on Report Addendum for Additional Data Collection in the Phase 1A Area, Omega Chemical Superfund Site, California

TO: Christopher Lichens/USEPA Region IX
FROM: Tom Perina/CH2M HILL, San Bernardino
DATE: September 22, 2003

As you requested, CH2M HILL reviewed the Report Addendum for Additional Data Collection in the Phase 1A Area, Omega Chemical Superfund Site, California, prepared by Camp Dresser & McKee, Inc. (CDM), dated June 27, 2003. General technical comments are provided first, followed by specific comments that relate to a particular section or Appendix of the document.

Comments by Tom Perina

General Comments

1. The report covers field data collection activities that included well installation, aquifer testing, and groundwater sampling, and further activities that included laboratory analysis, aquifer test analysis, and assessment of contaminant fate and transport. The field activities, laboratory results, and analysis of data are well documented, and interpretations and conclusions are clearly presented. The report should provide some additional information on the groundwater sampling and aquifer testing procedures. The interpretative sections should be expanded and the wording of some arguments revised. These issues are addressed by specific comments.
2. The report presents new hydrogeologic and contaminant distribution data. Lithologic cross-sections should be prepared and included in the report for the benefit of the discussion in the text. The cross-sections should also show groundwater elevations and contaminant concentrations.
3. The argument for natural degradation of contaminants of concern in groundwater at the site is well established. However, the report should revise the wording throughout the report where the text states that *data demonstrate the contaminants attenuate with depth (or distance)*, or that *attenuation was observed*. Generally, attenuation of contaminants is not *observed* in field conditions. The natural attenuation processes can be only indirectly inferred; the regulatory community has long been in acceptance of such evidence. The text also seems to misapply the term *attenuation*, which usually relates to natural attenuation processes (such as degradation, sorption, and dilution), to the characterization of the spatial extent of the contamination, which may also be controlled by other factors. The text should clearly distinguish between processes that limit the extent of the contamination.

4. The conclusions regarding commingling with a plume originating from an off-site source seem to be too strong for the supporting data available. The elevated contaminant concentrations measured in groundwater samples from downgradient wells can also be explained by slightly alternate contaminant migration pathways and contaminant distribution within the plume. The aquifer is heterogeneous and the release of contamination into the subsurface was likely time varying; as a result, the contaminant distribution is expected to be non-uniform. The presented data constitute a line of evidence that an off-site source may be contributing to contaminant concentrations downgradient of the site. Supporting information will be needed to verify the contribution from a potential off-site source.

Specific Comments

Reference Location	Comment
1. Page 2-1	<p>The text should present the following information:</p> <p>what type/model of pump was used</p> <p>which wells were monitored as observation wells</p> <p>duration of pre-test water level monitoring</p> <p>frequency of flow rate monitoring</p> <p>how was flow rate measured (using an in-line flow-totalizer?)</p> <p>did manual water level readings confirm pressure transducer recordings?</p>
2. Page 2-3, 1 st paragraph;	<p>The text refers to sampling procedures: "... as previously described in section 2.1.1....." Section 2.1.1 deals with groundwater sampling during aquifer testing. The text should describe the sampling methodology used (e.g., low-flow, micro-purge, 3-well volume purging, etc.).</p>
3. Page 2-3	<p>The report should identify the direct reading instrument used (make, model).</p>
4. Page 2-4	<p>The 2nd to last paragraph on page 2-4 describes the use of dedicated tubing and a portable submersible pump. The sampling procedures should be completely described in this section, perhaps under a separate sub-heading.</p>
5. Page 2-4	<p>The text should identify analytical methods used for nitrate/nitrite, dissolved oxygen, methane/ethane/ethene, hexavalent chromium, 1,4-dioxane, and perchlorate.</p>
6. Section 3	<p>Lithologic cross-sections should be constructed to illustrate the discussion of the alluvial channel, fine-grained material above the water table, depth and horizontal extent of contamination, and heterogeneity of the subsurface soils. Two cross-sections, one roughly along the groundwater flow path (approx. extending from OW1 to OW4) and one nearly perpendicular to the groundwater flow (approx. extending from OW2 to OW3, or H7 to H11), should be included at minimum.</p>
7. Page 3-2, Section 3.3.1	<p>Well construction is presented in Table 3-1, not in Table 3-3.</p>
8. Section 3.3	<p>The report should present time-series graphs for selected compounds for the benefit of the discussion. As a suggestion, the time series could be effectively shown as figure inserts because Phase 1A area includes only 8 wells.</p>
9. Page 3-3, 3 rd paragraph	<p>The last sentence should be revised; remove the word <i>demonstrate</i>. The data do not "demonstrate attenuation of the contaminants with depth", they indicate a limited vertical extent; see general comment no. 3.</p>

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10. Page 3-4, Washington Blv. Wells, 1 st paragraph	The statement "...chlorinated VOC concentrations, therefore, were observed to attenuate..." should be revised; see general comment no. 3.
11. Page 3-5, 1 st paragraph	The statement: "...attenuate with increased depth..." should be revised using less strong wording, such as, for example, "data indicate that vertical extent of contamination is limited"; see general comment no. 3.
12. Page 3-6, section 3.3.4, last paragraph	The statement: "...were observed to attenuate..." should be revised; see general comment no. 3.
13. Page 3-8, section 3.4.1, last paragraph	Another explanation of the increased concentration is that a cross-gradient portion of the plume was tapped via a preferential groundwater flow pathway, such as the sand channel, due to the changed flow field during the test.
14. Page 3-9	The correct spelling of the name of the software used is AQTESOLV. The text should cite the references for the software and for the methods used.
15. Page 3-9, 2 nd paragraph	<p>The text should clarify the rationale for performing the analysis by both manual and computer-assisted straight-line fitting. The graphs in Appendix E seem to show that manually recorded drawdown was used in the manual fitting and pressure transducer data were imported into AQTESOLV. The AQTESOLV plots also seem to be the results of manual straight-line matching as opposed to linear regression (it is noted that linear regression should not be used for the presented test data).</p> <p>As noted in comment no. 1, the report should discuss how the manual drawdown data compared to the electronically recorded drawdowns. Typically, the manual readings are taken as a backup and, for long-term tests, to correct for transducer drift (this likely was not a concern for the short-term tests). Any discrepancy (it exists) between the manually and electronically collected time-drawdown data should be resolved.</p> <p>The difference between the results of the analysis of manually and electronically collected data may result from different values of drawdown and different length of recording.</p>
16. Page 3-9	<p>The assumptions for the Theis method can be included by reference. It would suffice to state that an unconfined aquifer response is identical to that of a confined aquifer during early times of pumping.</p> <p>The term water table in the last bullet is not appropriate, because the aquifer is assumed to be confined for the Theis method. Also, there may be (uniform) flow in the aquifer for the method to be valid.</p>
17. Page 3-9, section 3.4.2	<p>The Theis method and its straight-line approximations are applicable to observation well drawdown. If they are used for analyzing the pumping well drawdown, effects of wellbore storage, skin, and well loss, as well as variable extraction rate need to be considered. The method can still yield useful results.</p> <p>It is suggested that other methods than the Theis method are applied; for example, The Papadopoulos and Cooper method (Papadopoulos, I. S. and H. H. Cooper. 1973. Drawdown in a well of large diameter, Water Resources Research, vol. 3, pp. 241-244.) accounts for wellbore storage and the Moench's well function (Moench, A. F., 1997. Flow to a well of finite diameter in a homogeneous, anisotropic water table aquifer. Water Resources Research, vol. 33, no. 6, pp. 1397-1407; Moench, A. F., 1998. Correction to "Flow to a well of finite diameter in a homogeneous, anisotropic water table aquifer" by Allen Moench. Water Resources Research, vol. 34, no. 9, pp. 2431-2432) accounts for the wellbore storage, skin, and unconfined aquifer.</p> <p>It is generally more appropriate to select one well function based on the type of the well and aquifer response, length of the test, quality of data, and other information.</p>

Reference Location	Comment
	If multiple methods, such as Theis and Cooper-Jacob, are used, the report should discuss the reasons for the difference between their results. Similar approach applies to the analysis of pumping and recovery. Note that curve-fitting methods can be simultaneously applied to the pumping and recovery data. The report should discuss the goodness of fit and select the method considered the most representative of the test conditions, rather than use an average without further discussion.
18. Page 3-1, section 3.2	The text should discuss groundwater flow gradient, its change in time and across the site. Hydrographs should be presented and seasonal groundwater elevations discussed.
19. Page 3-11, section 3.5	The text should briefly summarize the results of the data validation.
20. Section 4	The aquifer test results should be included in the conclusions.
21. Page 4-1, section 4.1.1	The text should discuss the groundwater flow gradient and seasonal fluctuations.
22. Page 4-1, section 4.1.2	<p>The text "...observed to attenuate with depth..." should be revised using less strong wording, such as, for example: "...indicate limited vertical extent..."; see general comment no. 3.</p> <p>The text states that contaminants "attenuate with increased distance downgradient" of the source. It is expected that the contaminant concentrations decrease with distance from the source area. However, the report should note that the location of the plume centerline is unknown. As a result, the magnitude of the change in contaminant concentrations with distance from the source is uncertain.</p> <p>The text discusses the sand channel in the vicinity of well OW8. Apparently, this channel may have a significant effect on the contaminant migration. The text should (briefly) discuss whether or not any characteristics of the channel, such as its possible orientation, could be inferred from the regional geology of the area.</p>
23. Page 4-1, section 4.1.3	The text should present the advective velocity and discuss the contaminant migration rate.
24. Page 4-1, section 4.1.3	The text should discuss the source of contamination measured in groundwater samples from well OW7.
25. Page 4-1, section 4.1.3	The text should discuss the presence of acetone and non-detection of PCE and TCE in well OW4b in comparison with the presence of PCE and TCE and non-detection of acetone in well OW4a. Acetone also was not detected in samples from source well OW1. Could the acetone have originated from another source?
26. Page 4-2, 2 nd paragraph	The text should note that wells OW1, OW8 and OW4, OW5 are only approximately located along a flow line. Considering the heterogeneity of the shallow aquifer, especially the presence of sand channels, the flow lines are likely tortuous; as a result, the wells in each pair may not lie on the same flow line.
27. Page 4-2, 3 rd paragraph	<p>The ratios of concentrations are a good indication of the degradation of the contaminants and provide a convincing argument that natural degradation of chlorinated compounds is occurring at the site.</p> <p>The commingling with another plume is possible; however, the report should mention that the increased concentrations in the downgradient wells can also be explained by tortuous migration pathways and non-uniform contaminant distribution in the aquifer. Additional data may strengthen the argument that the plume is commingling with off-site contamination.</p>
28. Section 4.2	Recommendation on extraction well type in the first sentence seems to be out of context. The text should include an introductory statement.

Reference Location	Comment
29. Section 4.2	<p>Direct push techniques seem to be the most efficient way to map the lithology and contaminant distribution in the shallow subsurface at the site. However, the installation of additional permanent wells is recommended to allow routine sampling and better depth control of the groundwater samples.</p> <p>The report states (on page 4-2) that the high concentrations of perchloroethene (PCE), up to 50% of its aqueous solubility, are a strong indication of the presence of dense non-aqueous phase liquid (DNAPL) in the source area. The distribution of DNAPL at the site should be characterized. It is recommended that a direct-push based method, such as membrane interface probe (MIP) in combination with cone penetrometer testing (CPT) is used, followed by soil and liquid sampling, and well installation. Detailed mapping of soil properties is essential for characterizing DNAPL distribution at the site. The possibility of DNAPL presence below the shallow groundwater zone will also need to be addressed.</p> <p>The selected site remedy should also target DNAPL.</p>
30. Appendix E	<p>It is noted that the recorded recovery period was short, less than 30 minutes. Longer and more complete recovery is usually desirable.</p> <p>Consistent units should be used throughout the report (some plots show transmissivity units as gal/day/foot).</p> <p>The straight fit line for the Theis recovery method should pass through intercept 1.0 on the t/t' axis in plots E-7, E-13, and E-16. These data show the effects of wellbore storage and possibly low permeability skin, as well as incomplete recovery.</p> <p>The following is an editorial comment rather than a technical one: why are the values on the y-axis increasing downward on the time-drawdown plots (i.e., the plots are upside-down)? Drawdown is treated as a positive quantity.</p>

Comments by Artemis Antipas

General Comments

1. Data validation reports presented in Appendix G are per EPA Functional Guidance and present a comprehensive review of the specific batch covered by the report.
2. Full laboratory data packages corresponding to the data validation reports are needed for the EPA review. The document currently presents limited laboratory data, due to size of the full packages these may need to be presented separately.
3. Need a full listing of the sample delivery groups along with a description of the methodology used to select the 10% for validation.
4. Need to describe how the data were flagged for final reports. Were data validation/ data review flags incorporated?
5. For data comparability and establishing contamination trends, data flagging needs to incorporate the following:
 - For the database at large, a consistent level of flagging needs to be implemented. If the data flags were limited to the 10% of the data this would not provide for data consistency or comparability. The level of flagging needs to be detailed. For 90% of the data that is not being validated flagging can be based on QC data summaries to

include calibration and other internal standards rather than just accuracy /precision/ blank data. This would provide qualification needed for project decisions, particularly at low levels or concentrations close to levels of concern.

- For data comparability, data validation flags could be based on simply control limits without reviewer 's professional judgment to eliminate differences; e.g. Method 8260 data validation report section VI for OC-GW-OW1-02193, OC-GW-OW2-02193, OC-GW-OW1B-02193.